International Journal Of Advancement In Engineering Technology, Management and Applied Science (IJAETMAS)
ISSN: 2349-3224 || www.ijaetmas.com || Volume 03 - Issue 07 || July 2016 || PP. 149-151

STUDY OF SEMICONDUCTOR AND FORMATION OF ENERGY BANDS IN SOLIDS

Dr.Kale H. G.
Department of Physics, Late. Nitin Arts And Science College, Pathri
Tq. Pathri Dist. Parbhani-431501 (M.S.) India

ABSTRACT:
Material s can be classified on the basis of their electrical conductivity, those materials have large no of free electron called as conductor and those material have less no of free electron called insulator and conductivity lies between conductor and insulator called as semiconductor. The conductivity of material depends on crystal structure, nature of bonding and availability of free charges. In conduction band forbidden gap is small, in insulator forbidden gap is large and in semiconductor it is intermediate between conductor and insulator.

KEYWORDS*:conductor, insulator, semiconductor, forbidden.*

I. INTRODUCTION

We know that electron revolve around nucleus only in permitted orbit and energy of electron depends on its orbit size that is energy levels are fixed according to its orbit no. PauliExclusion Principle determines the maximum no of electron which can accommodated in each energy levels.ie. 1s,2s,2p,3s.Metals are good conductor of electricity, insulator do not conduct electricity,while the semiconductor have conductivity inbetween conductor and insulator.

II. METHODOLOGY

2.1 Semiconductor

In semiconductor the conduction band and valence band are separated by very small energy gap.For ex. silicon (Si) this gap is 1.1ev and for germanium (Ge) this gap is 0.68 ev. Silicon has atomic no. 14 and electronic configuration $(1S)^2$ $(2S)^2$ $(2P)^6$ $(3S)^2(3P)^2$each silicon atoms makes covalent bonding with its neighboring four atoms Verma, (2009)there are two types of semiconductor.

2.1.1 Intrinsic semiconductor:

Pure semiconductor is called intrinsic semiconductor. They have four electron In outermost orbit of atom and held together by covalent bond. Because of less no. of charge carrier at room temperature intrinsic semiconductor have low conductivity so they have no practical use. Si atom has four valence electron with its four neighbour atoms and also takes share of one electron from each neighbor. These all atoms complete their octet. At zero temperature no electron are available for conduction and Si behave as insulator and at room temperature electron absorb energy and few covalent bondare broken and electrons raised to conduction band. The departure of electron from valence band creates vacancy in band so called hole and behave if it is positive charge when potential difference is applied across semiconductor electron and holes contribute to current. In intrinsic semiconductor has equal no. of free electron and holes.ie. $N_e = N_h$Hallida*yet. al.* (2008).

s2.1.2 Extrinsic semiconductor

Impure semiconductor is called extrinsic semiconductor. At room temperature the conductivity of intrinsic semiconductor is small to be used for any practical application. Conductivity of intrinsic semiconductor can be permanentlymodified by adding some impurities. The process of adding impurities to pure semiconductor is called dopping. Doped semiconductor is called extrinsic semiconductor. Their conductivity is very high and they are used for practical purpose. Extrinsic semiconductor are two typesHallida*yet. al.* (2008).

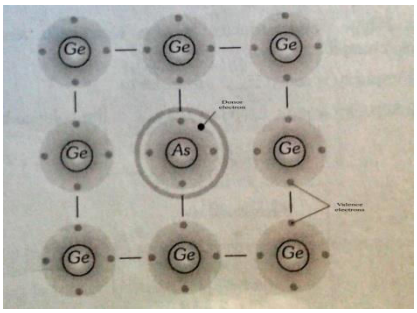
a) n type semiconductor

These are obtained by adding a small amount of pentavalent impurities to a pure semiconductor (Ge)Gupta, (2001).

1. Majority charge carrier are - electron
2. Minority charge carrier are - holes

International Journal Of Advancement In Engineering Technology, Management and Applied Science (IJAETMAS)
ISSN: 2349-3224 || www.ijaetmas.com || Volume 03 - Issue 07 || July 2016 || PP. 149-151

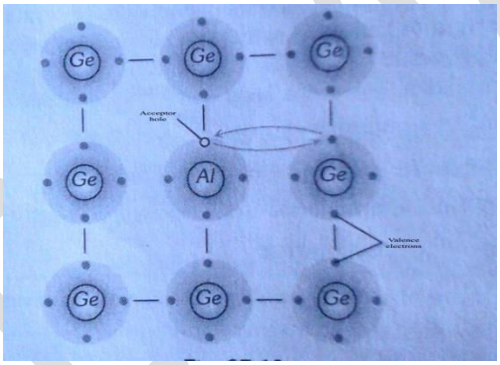
3. $N_e >> N_h$ ie. $I_e >> I_h$
4. It is electrically neutral (not negative charge).
5. Impurities are called donorimpurities.



b) p type semiconductor

These obtained by adding small amount of trivalent impurities to pure semiconductor (Ge)Gupta, (2001).

1. Majority charge carrier are - holes
2. Minority charge carrier are - electron
3. $N_h >> N_e$ ie. $I_h >> I_e$
4. It is also electrically neutral (not positive charge).
5. Impurities are called acceptor impurites.



2.2 Energy bands in solid

In isolated atom there are single energy level (.hydrogen atom) in solid atoms are arranged in systematic space lattice engineering physics Gaur& Gupta, (2011). The electrons in inner orbit are strongly bounded with nucleus and the electron in the outermost orbit is loosely bounded with nucleus. The electron in outermost orbit called valence electron. Conduction band and valence band are separated by a region or gap called forbidden gap.

2.2.1 Conductor: In case of conductor there is no forbidden gap and valence band and conduction band overlap each other (fig.a) here large no free electron are available to move in conduction band.

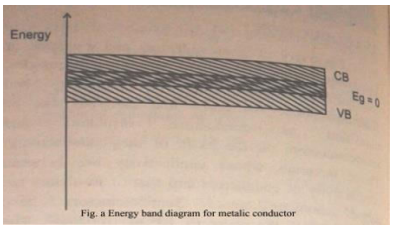


Fig. a Energy band diagram for metalic conductor

2.2.2 Semiconductor: In semiconductor forbidden gap is very small (fig.b)ex. Ge and Si. Semiconductor material which conductivity lies between conductor and insulator.

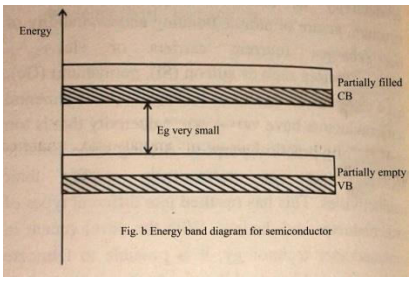


Fig. b Energy band diagram for semiconductor

2.2.3 Insulator: In case of insulator the forbidden energy gap is wide (fig.c). due to this electron cannot jump from valence band to conduction band. In insulator valence electron are tightly bounded with their neighboring atoms. Ex. Glass material the valence band is completely filled at 0^0K and the energy gap between valence band and conduction band is of the order of 10 ev. Even applied high electric field the electron does not jump from valence band to conduction band. Theresistivity of insulator is of the order 10^7ohm-meter.

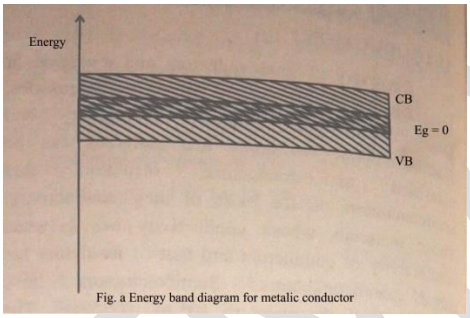


Fig. a Energy band diagram for metalic conductor

III. CONCLUSION

Some materials which are insulator at zero temperature and becomes conductor at room temperature. The important point in conductor due to the absence of forbidden gap there is no structure to establish holes. The total current in the conductor is simply flow of electron. In insulator forbidden gap is wide.

REFERENCES

[1] Halliday, Resnick, Walker.(2008).6th ed. "*Fundamentals of Physics"*.Wiley India Pvt. Ltd. 1040-1046.
[2] Gaur R. K. and S. L. Gupta. Rept.(2011)."*Engineering Physics"*Dhanpat Rai Publication Pvt. Ltd. 60.1.
[3] Satish k. Gupta. (2001)."*Modern Physics"*.Modern publishers.Vol (II). 900-902.
[4] H.C.Verma. (2009). "*Concept of Physics"*.Bharti Bhavan (P & D). Vol (2).397-398.